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ABSTRACT

This study examined salary discrimination by race and sex for faculty of higher education institutions. Data were obtained from the 1993 National Study of Postsecondary Faculty (NSOPF-93), a cross-sectional survey of 817 public and private higher education institutions and 25,780 faculty. The findings indicated that while the salary gap between white and nonwhite faculty groups was not statistically significant, sex discrimination in faculty salaries still exists. Female faculty members received 6.6 to 9.0 percent less than their male counterparts in 1992, controlling for degree, rank, professional experience, discipline, union membership, and other factors. The proportions of salary differentials varied depending on the specific model used. Although there were no fundamental differences in the sign and statistical significance of the coefficients between pooled and separate models by sex, in separate models minority group membership had significant effects on faculty salary across the models, except for the basic model for the female group. However, male or female minority faculty members enjoyed either a salary advantage or suffered a salary disadvantage depending on the model used. It was concluded that the interpretation of salary differentials by race should be carefully made, since the coefficients are sensitive to the model used. (Contains 43 references.) (MDM)

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Faculty Salary Revisited: Discrimination by Sex and Race

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Presented at the 22nd Comference of the Association of the Study of Higher Education
Novcmber 1997, Albuquerque, New Mexico

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ABSTRACT

Faculty Salary Revisited: Discrimination by Sex and Race

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The purpose of this study is to investigate salary discrimination by sex and race for faculty of higher education institutions. The data used in this study come from the 1993 National Study of Postsecondary Faculty conducted by the National Center for Education Statistics. This study uses Blinder-Oaxaca method to measure the effects of salary discrimination. The findings of this study show that while the salary gap between white and non-white faculty groups is not statistically significant, sex discrimination in faculty salary still exists. The total salary gap between the two groups, male and female professors, is about 25%. Approximately 10% of the total salary gap between male and female groups can be attributable to the effects of discrimination.

Faculty Salary Revisited: Discrimination by Sex and Race[1]

Despite the various legal efforts, such as the Equal Employment Opportunity Act of 1972, Title IX of the Education Amendments of 1972, and affirmative action programs initiated at an institution level, gender disparity in faculty salary of higher education institutions appears to have existed during the last two decades. Recently, gender discrimination in faculty salary has had a renewed attention through the lawsuit against Illinois State University. The case began in March 1995 when three female professors in the College of Business sued the university in federal court in Illinois. They claimed that their salaries were among the lowest in the college because they are women(The Chronicle of Higher Education, Nov. 8, 1996; A10-11).

For the last decades, studies have consistently shown that there exists sex differential or discrimination in faculty salary. Although affirmative action programs have contributed to overcome the effects of past discrimination by giving some form of preferential treatment to ethnic minorities and women since 1970s, female faculty has not benefited from the programs as much as ethnic minority groups have in terms of monetary compensation. Dwyer, Flynn, and Inman(1991), in a review of the literature on salary discrimination for faculty members, found a consistent pattern of lower pay for females. In a massive review of literature and through empirical analyses of male/female faculty salary differentials over the period 1960s -1980s, Barbezat(1989) and Ransom & Megdal(1993) concluded that although "gender gap" in higher education narrowed substantially during 1970s, relative pay of women did not improve in the 1980s. In contrast, minority groups, especially Black, have enjoyed the salary advantage relative to their counterpart, white group, resulting from so called the "reverse discrimination"(Gordon et. al., 1974; Hoffman, 1976; Traynham, 1977; Barbezat, 1989).

The purpose of this study is to investigate wage discrimination by sex and race for faculty of higher education institutions. Using a recent national data set, this study examines salary differentials by sex and race for the market as a whole. It is hypothesized that salary inequalities

[1] This paper was presented at the 22nd Conference of the Association of the Study of Higher Education, November 1997, Albuquerque, New Mexico.

by gender and race tend to exist for university faculty, controlling for their qualifications and other relevant factors, and that earnings differences by gender may be larger than those by race.

Literature Review

Empirical studies of faculty salary differentials have focused more on sex discrimination than on racial differences. These studies suggest that sex discrimination in faculty salary exists, while discrimination by race is not conspicuous. Using nationally representative survey data from American Council on Education, Bayer and Astin(1975) found that male professors enjoyed a salary advantage in 1972, controlling for degree level, productivity, continuous employment, and other variables. During the 1970s, many researchers confirmed that sex discrimination existed against female faculty members at individual institutions(Katz, 1973; Gordon, Morton, and Braden, 1974; Kock and Chizmar, 1976). Discrimination in faculty salaries by gender was continuously found during 1980s as well(Megdal and Ransom, 1985; Barbezat, 1987b, 1989; Kelly, 1989; Smart, 1991).

Findings of studies using national level data sets are also consistent with those of prior institutional research and studies using discipline based sub-samples. Using data from National Science Foundation, Johnson and Stafford(1974) found that the academic salaries of females start out not much less than those of males and then decrease to a fairly substantial differential after a number of years of professional experience. The findings of Jusenius and Scheffler(1981), using a sample of Ph.D. economists, also supported that earning differentials between male and female faculty widened over time. More recently, analyzing three national faculty data sets over two decades, Barbezat(1987b, 1989) found that affirmative action in higher education played an important role in reducing faculty salary differences between 1968 and 1977, but the impact of the action on salary differentials diluted over time, especially between 1977 and 1984. Using causal modeling procedures and 1984 national survey of faculty conducted by the Carnegie Foundation for the Advancement of Teaching, Smart(1991) concluded that gender had statistically significant "direct" and "indirect" effects on salary attainment, and that the magnitude of salary inequity attributable to gender may be greater than previously found, since the previous studies did not adequately take into account indirect effects of gender. Using four

national data sets, Ransom and Megdal(1993) also confirmed the findings of Barbezat; the trend of sex discrimination in faculty salary between 1960s and 1980s. Furthermore, they found that most of the effect of discrimination was to lower female salaries.

Studies on salary differentials by race have had mixed results. Gordon, Morton, and Braden(1974) found that black academics at a university received a large salary premium, 13% on average, in 1970. When Hoffman(1976) replicated the analysis of Gordon et. al. (1974) for another university, the author also found that black faculty members enjoyed a 7% salary advantage relative to other similarly qualified academics. Barbezat(1989) showed that black faculty members took a salary disadvantage in 1968, but they enjoyed a proportionate salary advantage in 1977, although both results were not statistically significant. By contrast, Jusenius and Scheffler(1981), using 1973 National Academy of Sciences' data, concluded that at all stages of their careers, black academic economists earned substantially less than their white counterparts. Studies of faculty salary differentials reviewed in this section are summarized in Table 1.

Most of the studies reviewed in this section used the multiple regression method with cross-sectional data to estimate salary differential or discrimination by gender. Pointing out a couple of disadvantages of conventional regression techniques in research on rank and salary attainment, Smart(1991) employed a "causal modeling procedure," a path analysis, to examine how gender influences salary in both direct and indirect ways. Despite the dispute about the adequacy of regression analysis to estimate gender or racial discrimination, however, regression analysis has been generally accepted in discrimination case(Raymond et. al., 1990; p.197). The studies reviewed in this paper shows that sex discrimination exists, although the magnitude of discrimination by sex appears to vary depending on the model and independent variables.

Analytic Method

One popular technique used extensively in salary equity studies is the multiple regression method. The methods for wage discrimination include the traditional multiple regression approach with dummy variables, such as gender and race, and Blinder-Oaxaca method. The traditional regression method uses dummy variables to estimate salary differentials by gender

and race. Use of the gender dummy variable only allows a test of the proposition that the salary levels of men and women differ by a constant term. As an example, assume, for simplicity, that the male and female college faculty's salary is a function of the years of teaching experience as follows:

$$Y_i = \alpha_1 + \alpha_2 D_i + \beta X_i + u_i$$

where Y_i = annual salary of a college professor
X_i = years of teaching experience
D_i = 1 if male
= 0 otherwise

The linear model assumes that the level of the male professor's mean salary is different from that of the female professor's mean salary by α_2 but *the rate of change* in the mean annual salary by years of experience is the same for both sexes. However, the assumption of the same rate of change in faculty salary between female and male professors is difficult to hold in reality.

In a synthetic review of literature, Finkelstein(1985) adequately described that "the current practices and the current reward system have evolved over time to meet the needs and orientations of the largest number of academics - majority male(p.323)." Fox(1981a; 1981b)[2] empirically found that academic salary formed a dual reward structure, and that sex segregation was one of the mechanisms that may be promoting the dual salary structure. She concluded that "achievements are the dominant salary determinants, but sex is a big divider of reward. The male and female returns for achieved, ascribed, and location characteristics are different not only in payment level, but also in payment structure(1981a, p.81)." Persell(1983) also found that the merit system is not operating equally for men and women in educational research. I employ the Chow test to examine the assumption of different reward system between two groups (for female and male) in this study.

Blinder(1973) and Oaxaca(1973) developed the most common econometric framework for measuring the effects of wage discrimination. It assumes that in the absence of discrimination the estimated effects of worker's endowments on earnings are identical for each group.

[2] The data in this study came from one university. The sample consisted of 5,450 individuals at the university.

Discrimination is revealed by differences in the estimated coefficients. Differences are not confined to intercept terms through simple dummy variable specification, but also include variations in estimated slope coefficients(Berndt, 1991; pp.182-183). Because I employ the technique for this study, I elaborate how to measure the effects of discrimination with Blinder-Oaxaca method.

Suppose that data on log salaries and professors' characteristics were collected from two groups, a male professor group, denoted with a superscript asterisk, and a female group, denoted with a subscript asterisk. Using these data on faculty's salaries and their endowments of productivity-enhancing characteristics(highest degree, experience, etc.), first estimate by least squares the separate statistical earnings functions equations for these two groups, that is, estimate parameters in $\ln y^{*} = X^{*}\beta^{*} + \mu^{*}$ for the male professor group and $\ln y_{*} = X_{*}\beta_{*} + \mu_{*}$ for female professor group, where y and μ are vectors of wages and random disturbance terms and X is a matrix of observations on the same explanatory variables(experience, productivity, etc.).

The fitted regression line passes through the point of sample means,

$$\overline{\ln y^{*}} = \overline{X^{*}}b^{*} \quad \text{and} \quad \overline{\ln y_{*}} = \overline{X_{*}}b_{*} \qquad (3.1)$$

and that the mean difference in the predicted log salaries for the two groups is

$$\overline{\ln y^{*}} - \overline{\ln y_{*}} = \overline{X^{*}}b^{*} - \overline{X_{*}}b_{*} \qquad (3.2)$$

The difference between the male and female coefficient vectors is

$$\Delta b \equiv b^{*} - b_{*} \text{ implying that } b_{*} = b^{*} - \Delta b \qquad (3.3)$$

Substituting the second equation in Eq. (3.3) into Eq. (3.2) and rearranging yields

$$\overline{\ln y^{*}} - \overline{\ln y_{*}} = b^{*}\left(\overline{X^{*}} - \overline{X_{*}}\right) + \overline{X_{*}}\Delta b \qquad (3.4)$$

Equation (3.4) states that the mean difference in log earnings between the male and female professor groups can be decomposed into the effects of differences in their average endowments(the first term on the right-hand side of the equation), and *the effects of discrimination*, as revealed by differences in estimated coefficients(the second term).

Sample

The data used in this study come from the 1993 National Study of Postsecondary Faculty(NSOPF-93) conducted by the National Center for Education Statistics. The NSOPF-93 is a cross-sectional survey of 817 public and private nonproprietary higher education institutions and 25,780 faculty. Faculty data collection was conducted between January and December 1993. The faculty survey relied on a multi-modal data collection design which combined an initial mail survey with mail and telephone prompting supplemented by computer-assisted telephone interviewing(CATI). Questionnaires and follow-up mailings were sent out in large waves between January and July 1993. The response rate was 86.6%.

The data set has relevant information for this study on a national profile of faculty, including their professional backgrounds, responsibilities, workloads, salaries, benefits, and attitudes. After applying several restrictions, this final sample consists of 7,090 individuals. Table 2 shows the descriptive statistics for the variables used in this study.

Several restrictions were applied to the sample in this study. The sample includes only full, associate, and assistant professors. For the purpose of comparability of results, the sample is restricted to full-time faculty. Only faculty members working for research, doctoral, and comprehensive universities were included.

Variables

The explanatory variables employed in the faculty salary studies vary, depending on the theoretical perspective and purpose of the study. For example, a Marxist's perspective is sharply distinguished from that of human capitalists in terms of the role of 'discipline' in the faculty salary differential studies. The former argues that the discipline variable should not be included

in the model because the presence of the variable in the model can underestimate the effects of discrimination. On the contrary, the latter insists that since the value or price of faculty work is determined in the competitive market, the salary differences between disciplines reflect the market value, and it is reasonable to incorporate the disciplines into the model as another factor to influence faculty salary differentials. This study includes personal characteristics, educational achievement, professional experience, rank, productivity, and contextual factors, such as academic disciplines, and institutional type.

These general categories are also consistent with the theoretical perspectives, except for the rank variables, which is differentiated due to a methodological reason.[3] There are two fundamental perspectives that provide a framework for research on salary equity: Human capitalism and structuralism. The basic premise of the human capital approach is that variation in labor income are due, in part, to differences in labor quality in terms of the amount of human capital acquired by the workers(Cohn and Geske, 1990; p.34). Human capital can be considered, in this case, as educational achievement and professional experience. By contrast, structural/functionalism posits that status inequity results from larger structural and institutional mechanisms(Smart, 1991; p.512). It suggests that institutional factors play a crucial role in determining salary. Contextual factors, such as discipline and institutional type, are important, in this regard. This study used a set of independent variables representing each hypothetical perspective.

A variable indicating union membership of professors was included in the model in order to take into account the findings of studies on relationship between union and salary. Ashraf(1992) and Lillydahl & Singell(1993) found that unions have a significant positive effect on faculty salary.

It is notable, however, that researchers studying faculty salary differentials need to deal with a couple of variables with care. Hoffman(1976) demonstrated that omitting rank as an explanatory variable increased the measured amount of discrimination, almost doubling it. In addition, McCulley and Downey(1993) found that, in the multiple regression approach, number of years in service as an indication of institutional loyalty is operating as a "negative suppressor." Although they did not directly address how to avoid the undesirable situation, one can infer from

their results that researchers should not use the "stepwise" regression method to estimate salary differentials and be careful in the case of the existence of considerable multicollinearity among variables.

The natural logarithm of salary[4] was employed as the dependent variable. In this case, the coefficients of independent variables can be interpreted as percentage changes, instead of a unit increase of the dependent variable. Some of independent variables were modified for analysis. *Race*[5] was aggregated to white and other, which represents all other minority groups, such as black, Asian, and Hispanic. *Educational degree* was aggregated to professional or Ph.D. degree, and Master or Bachelor degree. *Professional experience* was operationally defined as the amount of time spent after obtaining his or her highest degree. It was estimated by subtracting year of his or her highest degree from 1992. Human capital theory suggests that earnings should generally not be constant after leaving school but should follow a parabolic shape, peaking somewhere in midlife. To capture this non-linear relationship between earnings and experience, a quadratic term of years of experience was included in the model. *Academic department*[6] was aggregated to agriculture or home economics, business, education, engineering, fine arts, health sciences, humanities, natural sciences, social sciences, and all other programs. *Institutional type* was also aggregated to Research, Doctoral, and Comprehensive universities. The more specific information on the variables used in this study is described in Table 3.

Models

This study utilizes three types of models: a basic model, expanded models, and separate models by sex. The basic model fits a common salary structure for both male and female faculty groups by OLS regression. The earning function equation of the basic model is as follows:

$$\ln S_i = \beta_0 + \beta_{1i} G_i + \beta_{2i} R_i + \beta_{3i} H_i + \beta_{4i} E_i + \beta_{4i} E_i^2 + \beta_{5i} A_i + \beta_{6i} P_i + \beta_{7i} U_i + \beta_{8i} T_i + \mu_i$$

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[3] It will be discussed later in detail.
[4] Basic salary.
[5] The variable name in the model is MINORITY.

where, for the *i*th faculty member, S_i stands for salary, G_i is gender, R_i is race, H_i is the highest degree individual professor has, E_i is professional experience, A_i is principal type of activity, teaching or research, P_i is research productivity, U_i is union membership, T_i is type of appointment, and u_i is the random disturbance term reflecting unobserved ability characteristics and the inherent randomness of earnings statistics. It is assumed that u_i is normally distributed with mean zero and constant variance. G_i, R_i, H_i, A_i, U_i are recoded into dichotomous variables.

Based on the discussion of variables having effects on estimation of discrimination, several expanded models were developed to obtain more accurate estimates of discrimination. Each expanded model was designed to include all the variables in the prior models. Variable sets are added in the following order: academic rank, disciplines, and institutional type and control. For example, an extended model with institutional type and control has all the variables in the basic model, as well as academic rank, disciplines, and institutional type and control variables.

The separate models by sex[7] parallel to the basic and the extended models. Only one difference is that the separate regressions were run for each group, male and female. For this reason, only the gender variable was dropped from the models, while all other variables remained in the model.

Results

Salary Differentials by Gender and Race

Table 4 shows that all variables are consistently significant across the models, except for minority membership and the quadratic term of professional experience. The quadratic term is significant at 1% level only in the basic model. For the variable indicating minority membership, the coefficients have a small negative value across the models, but are not significant. That is, there is no statistically significant difference in salary between white and non-white faculty, although the negative signs imply a salary disadvantage against non-white faculty. The

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[6] It stands for respondents' principal discipline of teaching.

[7] A rationale for developing separate models by gender lies in differences in faculty return by gender for achieved and ascribed characteristics, in terms of both in payment level and in payment structure. To test for differences between two regressions(for male and female groups), I employ the Chow test.

significant negative coefficient of the quadratic term in the basic model supports the hypothesis of human capital theory about the relationship between earnings and experience. However, the hypothesis does not hold for other expanded models.

The coefficients of FEMALE variable show that female faculty members receive approximately 6.6% - 9.0% less than their male counterparts in 1992. The proportions of salary differential vary depending on the model in the study. They are very consistent with those of the 1984 salary gaps analyzed by Babezat(1989). It is notable that the more variables that are added to the model, the smaller the value of the coefficients of FEMALE. It means that academic rank of faculty and institutional factors tend to underestimate gender discrimination.

For the basic model, faculty members holding a Ph.D. or a professional degree earn 20% more than those who have a master or a bachelor degree. Professors who are engaged primarily in teaching tend to receive lower pecuniary rewards than those whose primary activity is research. Number of articles published in refereed journal, both for career and for the last two years, as a proxy for research productivity has a significant effect on salary. However, it appears that productivity for the recent years has more monetary effects on salary than that for the entire career.

Consistent with findings of previous studies, faculty members holding union membership have higher salary than those who do not by about 3% in the basic model. The proportion of the union effect appears to increase by adding the sets of independent variables to the model. The union wage effect in this study is comparable to that of Ashraft(1992), who used data from the 1977 Survey of the American Professorate.

While the effects of discipline on faculty salary vary, those of institutional type are in order: Research, Doctoral, and Comprehensive. Faculty members working at research universities earn about 15% more than their colleagues at comprehensive universities. Similarly, professors at doctoral universities earn about 5% more than those who working at comprehensive higher education institutions. Faculty members in private universities earn about 7% more than those in public universities. Adjusted R squares, ranging from .407 to .551, show that the models are successfully fitted. Each reference group for a set of dummy variables is described at the bottom of Table 4, except for a reference group for disciplines, of which reference group is all other programs.

Salary Discrimination by Gender

Using the separate regressions[8] by gender and Blinder-Oaxaca method, we can decompose the salary differentials into two portions: the effects of differences in their average observed characteristics, and the effects of discrimination. Before discussing salary discrimination by gender, it is worth reviewing the results of the separate regressions by sex. Although there is no fundamental difference in the signs and the significance of the coefficients between the pooled models and the separate models by sex, it is notable that, in the separate models, minority membership has significant effects on faculty salary across the models, except for the basic model for female group, as can be seen in Table 5. However, interestingly, the signs of coefficients indicate that male or female minority faculty members either enjoyed a salary advantage or suffered a salary disadvantage depending on the model used in the study. The interpretation of the salary differentials by race should be carefully made since the coefficients appear to be sensitive to the model used in this study.

According to Blinder-Oaxaca method for estimating discrimination, first, we need to know the total salary gap between male and female faculty groups. To do this, I calculate the mean salary for male and female faculty groups. From Equation (3.1), the mean salary equals the product of the mean values of each groups independent variables and their estimated coefficients. The mean *ln* salaries for male and female professors are 10.83 and 10.61 for the basic model, respectively. The total salary gap between the two groups is about 25%.

Second, to decompose the total salary difference into the "legitimate"[9] portion and the discrimination portion, we need to assume that the reward systems are identical for male and female faculty in a non-discriminatory world. Given the assumption, if female faculty members were paid according to the male counterparts' salary structure, their mean salary would be 10.702. The salary gap between the two groups in this case would be 14%. It suggests that the remaining 11% of the 25% total salary difference may result from discrimination.

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[8] To test for differences between two regressions(for male and female groups), I used the Chow test. The Chow test statistics shows that the two regressions are different.

[9] By "legitimate," I mean the portion that is the result of differences in observed characteristics.

Table 6 shows that approximately 10% of the total salary gap between male and female faculty groups can be attributable to the effects of discrimination. Consistent with the findings of Hoffman(1976) and Barbezat(1989) about the role of academic rank variables in estimating discrimination, the results of this study indicate that the regression model with rank variables tends to lower the proportion of discrimination by about 1%.

Conclusion

The findings of this study show that while the salary gap between white and non-white faculty groups is not statistically significant,[10] sex discrimination in faculty salary still exists. Female faculty members receive approximately 6.6% - 9.0% less than their male counterparts in 1992. The proportions of salary differentials vary depending on the model in the study. They are very consistent with those of salary gaps in 1984 analyzed by Babezat(1989), suggesting that salary differentials of faculty maintain the status quo between 1984 and 1993.

There is no statistically significant difference in salary between white and non-white faculty for the pooled groups, although the negative signs imply a salary disadvantage against non-white faculty. The significant negative coefficients of the quadratic term in the basic model support the hypothesis of human capital theory about the non-linear relationship between earnings and experience. However, the hypothesis does not hold for other expanded models. Institutional factors, such as discipline and institutional type and control, consistently have significant effects on faculty salary across the models. These results support the hypothesis of structural/functionalism that salary inequity results from larger structural and institutional mechanisms.

Although there is no fundamental difference in the signs and the statistical significance of the coefficients between the pooled models and the separate models by sex, it is notable that in the separate models minority membership has significant effects on faculty salary across the models, except for the basic model for female group. However, interestingly, the signs of coefficients indicate that male or female minority faculty members either enjoyed a salary advantage or suffered a salary disadvantage depending on the model used in the study. The

interpretation of the salary differentials by race should be carefully made, since the coefficients appear to be sensitive to the model used in this study.

According to Blinder-Oaxaca method for estimating discrimination, the total salary gap between the two groups, male and female professors, is about 25%. Approximately 10% of the total salary gaps between male and female faculty groups can be attributable to the effects of discrimination. In a recent study, Ransom and Megdal(1993) show that sex discrimination can be further decomposed into male overpayment and female underpayment components. Human capital theory of wage discrimination suggests that discrimination tends to lower the salaries of women and raise the salaries of men at the same time(Madden, 1975). According to their calculation with Oaxaca-Ransom method, their data demonstrate that discrimination increases male salaries only slightly, but it reduces female salaries by 5-9%, suggesting that gender discrimination may operate more in reducing female salaries than in raising male salaries. These results of further decomposition of gender discrimination have a practical implication for adopting a strategy to eliminate sex discrimination at an individual institution. Administrators should not attempt to reduce the salary increases of male faculty in order to compensate for the "lost" rewards of female faculty.

Consistent with the findings of Hoffman(1976) and Barbezat(1989) about the role of academic rank variables in estimating discrimination, the results of this study show that the regression model with rank variables tends to lower the proportion of discrimination by about 1%. Researchers should carefully deal with the academic rank variables in research on salary equity.

In-depth and widely spread gender discrimination in faculty salary make researchers need to have an ongoing interest in investigating the issue. Furthermore, researchers need to pay more attentions to the sources of sex discrimination in order to fundamentally eliminate the discrimination or find reasonable ways to reduce the salary differentials attributable to discrimination between male and female faculty members.

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[10] For the pooled regression analyses.

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Table 1. A Summary of Studies of Faculty Salary Differential/Discrimination by Sex and Race

Author	Year	Sample	Population	Method	Dependent variable	Findings	Focus
Bayer & Astin	1968	1,765	national (NSF[1])	t-test	Salary for 1964	• Across all work settings, fields, and ranks, women experience a significantly lower average academic income than do men in academic teaching for the same amount of time	
Loeb & Ferber	1971	128 - instructors	case study (one)	Multiple Regression	Salary for 1969-70	• Salary and rank is related to sex, suggesting discrimination against women Multiple R = .870	investigation of the existence and extent of sex based ineqalities in rank and pay
Katz	1973	596 - assistant professors	case study (one)	Multiple Regression	Salary for 1969-70	• Sex differentials exist • Explanation: the policy of hiring a professor's wife R^2 = .68	developing a more rational means of evaluating and rewarding university professors
Gordon, Morton, & Braden	1974	~1,500 full-time employees	case study (one)	Multiple Regression	Salary and *ln* salary for 1970	• Sex differentials exist • Explanation: sex as a proxy for career commitment R^2 = .79	investigation of discrimination by sex, race, and discipline
Johnson & Stafford	1974	600 - 5,000	national (NSF)	Multiple Regression	*ln* salary for 1970	• Academic salaries of females start out not much less than those of males and then decline to result in a fairly substantial differential after a number of years after a number of years of potential experience. • Explanation: discrimination(2/5) and human capital differences(3/5) R^2 = .41 - .63	the extent of the male-female salary and promotion differential for Ph.D.s in academic employment by field of specialization

[1] National Science Foundation

Author	Year	Sample	Population	Method	Dependent variable	Findings	Focus
Bayer & Astin	1975	4,998	national	Stepwise Regression	Salary for 1972-73	• In 1972-73 the average salary of academic men exceeded that of academic women by about $3,000. • The partial correlation between sex and salary was statistically significant, although the correlation was reduced, compared to that of 1968-69, suggesting that salary gap attributable to sex declined. Multiple R = .467	presenting estimates on a national scale of sex differentials in academic employment and of the extent to which equity has been approached since antibais regulations have been in effect.
Hoffman	1976	~1,500 (parallel study to G-M-B)	case study (two)	Multiple Regression	*ln* salary for1970	• Omitting rank as an explanatory variable increases the measured amount of discrimination, almost doubling it. R^2 = .79	replication of Gordon et. al.'s study w/o rank variable (to take into account slow promotion of female faculty: another discrimination)
Koch & Chizmar	1976	530 full-time & non-administrative faculty	case study (one)	Multiple Regression	Monthly salary for 1972, 1973 longitudinal	• Salary discrimination against female faculty members as a group did exist • This discrimination was eliminated by the Affirmative Action program • The Affirmative Action program has resulted in a "leaning over backward" effect in favor of female faculty which goes beyond the elimination of sex discrimination in salaries against female faculty R^2 = .68 - .80	[counter factual model used; detailed peer evaluations of each faculty member's productivity utilized]
Traynham & Green	1977	134 full-time faculty	case study (one)	Multiple Regression	9-month salary for 1975-76	• No evidence of salary discrimination against Blacks • Females appear to be underpaid, but statistically non-significant(.05) R^2 = .79	investigation of salary discrimination by sex and race(focus)

Author	Year	Sample	Population	Method	Dependent variable	Findings	Focus
Jusenius & Scheffler	1981	~5,000 full-time economist	national	Multiple Regression	*ln* 9-month salary for 1972	• The effect on earnings of several factors- years of work experience academic rank, primary work activity, and degree from a top-ten department- differ by race • Earning differentials between male and female faculty became wider over time(consistent with Johnson & Stafford(1973)) • At all stages of their careers, nonwhite male economists earn substantially less than their white counterparts R^2 = .48 - .89	[separate regressions for male - female, white - nonwhite groups]
Megdal & Ransom	1985	~1900	case study (one) 1972 1977 1982	Multiple Regression	Salary and *ln* salary for three years longitudinal	• Controlling for a set of individual characteristics, female faculty are paid less than male faculty. These differences persist over time. R^2 = .55 - .70	to determine the extent to which the salary structure at a large public university has changed since 1972
Kelly	1989	839 faculty in journalism	national	Multiple Regression	Salary for 1987 (ordinal level categories)	• Women is paid less than men when legitimate discriminating variables are controlled. • A change from female to male status would increase one's base salary by approximately $3,600, other things being equal. R^2 = .51	salary discrimination by gender and relationship between pay and job satisfaction

Author	Year	Sample	Population	Method	Dependent variable	Findings	Focus
Barbezat	1987 1989	13,613 3,021 1,791	1968 1977 1984 national	Multiple Regression	*ln* salary for 1968, 1977, 1984	• Gender differences in faculty salary changed over time. There were substantial gender differences in 1968; the extent of measured discrimination declined sharply in 1977; and the salary gap rose between 1977 and 1984. • In 1968, estimated coefficients for the black dummy variable were negative and insignificant; in 1977, coefficients were positive, but still insignificant. • Testing the Johnson/Stafford explanation of the source of male/female salary differences: (a)marital/parental status and salary; (b)female more involved in teaching (c)spouse occupation and salary R^2 = .21 - .65	investigation of gender differences in salary for the market as a whole, using four national faculty survey
Smart	1991	2,968 full-time four-year university faculty	1984 national	"Causal modeling" Structural equation analysis	Salary for 1984 (fifteen level measure)	• Gender has a statistically significant direct, indirect, and total effect on salary attainment. • Men academics have higher earnings than their women colleagues when controlling for all other variables in the model. • Continuing gender disparities in salaries exist, and the magnitude of that disparity be greater than previously assumed, primarily due to indirect effects of gender. 62% of variance explained	investigation of "indirect" effects of gender on salary

Author	Year	Sample	Population	Method	Dependent variable	Findings	Focus
Ransom & Megdal	1993	54,489 30,633 3,652 2,264	1969 1973 1977 1984 national	Multiple Regression	*ln* salary for 1969, 1973, 1977 and 1984	• There were clearly significant improvements in relative pay in the early and mid-1970s. But since 1977, the relative pay of women apparently has not improved. • Women faculty members are, on average, paid significantly less than equally capable men. Nationally, relative pay of women probably did not improve in the late 1970s and early 1980s. • Male salaries are slightly higher than they would be in a non-discriminatory setting, but most of the effect of discrimination is to lower female salaries. R^2 = .15 - .59	to examine the relative pay of women in the academic labor market between 1969 - 1984

Table 2.

Descriptive Statistics for the Pooled Sample (n=7,090)

Variable	*Mean*	*Std. Deviation*
ln salary	10.78	.34
Teaching	.80	.40
Years of professional experience	14.93	9.97
A quadratic term of the years of professional experience	322.31	358.52
No. of articles during career	17.82	34.82
No. of articles during the last 2 years	2.64	4.19
Union membership	.18	.39
Female	.25	.43
Minority	.13	.34
Ph.D.	.87	.34
Length of appointment	9.83	1.34
Associate professor	.31	.46
Assistant professor	.31	.46
Agriculture	.03	.18
Business Administration	.08	.27
Education	.08	.27
Engineering	.06	.24
Fine Arts	.06	.24
Health Science	1.00	.30
Humanities	.13	.33
Natual Sciences	.22	.42
Social Sciences	.13	.34
Research universities	.42	.49
Doctoral universities	.18	.38
Institutional Control	1.26	.44

Table 3. Descriptions of Variables in the Analysis

Variable	Description
Salary	Natural logarithm of basic salary for the calendar year 1992. This is the dependent variable.
Personal	
Female	A dummy variable indicating faculty gender (0=male; 1=female)
Minority	A dummy variable indicating faculty racial/ethnic group (0=White; 1=Black, Native, Hispanic, and Asian Americans)
Educational achievement	
Ph.D.	A dummy variable which indicated faculty's highest degree (0=Master or Bachelor; 1=Ph.D. or professional degree)
Experience	
Years of professional experience	A continuous variable measuring years of experience after obtaining Ph.D. It is estimated by subtracting year of Ph.D. from 1992. This variable serves as an indicator of professional experience.
A quadratic term	A quadratic term of years of professional experience
Activity	
Teaching	A dummy variable indicating teaching as professor's principal activity at the institution (0=no; 1=yes)
Research	A dummy variable indicating research as professor's principal activity at the institution (0=no; 1=yes)
Productivity	
No. of articles during career	Number of articles published in refereed journal during career.
No. of articles during the last 2 years	Number of articles published in refereed journal during the last 2 years.
Others	
Union	A dummy variable indicating union membership of faculty(0=no; 1=yes)
Type of appointment	A variable indicating the length of appointment, which measured by month.
Academic Rank	
Full professor	A dummy variable indicating full-professor(0=no; 1=yes)
Associate professor	A dummy variable indicating associate professor(0=no; 1=yes)
Assistant professor	A dummy variable indicating assistant professor(0=no; 1=yes)

Contextual factors

Agriculture	A dummy variable indicating Agriculture
Business	A dummy variable indicating Business Administration
Education	A dummy variable indicating Education
Engineering	A dummy variable indicating Engineering
Fine Arts	A dummy variable indicating Fine Arts
Health Science	A dummy variable indicating Health Science
Humanities	A dummy variable indicating Humanities
Natural Sciences	A dummy variable indicating Natural Sciences
Social Sciences	A dummy variable indicating Social Sciences
All other disciplines	A dummy variable indicating all other disciplines
Research universities	A dummy variable indicating Research universities
Doctoral universities	A dummy variable indicating Doctoral universities
Comprehensive universities	A dummy variable indicating Comprehensive universities
Institutional control	A dummy variable indicating the institutional control coded into 1, if private, and 2, if public.

Table 4. Summary Statistics for Regression Models with the Pooled Sample

Variable	Basic model		with Rank		with Discipline		with Institutional type	
	b	sig.	b	sig.	b	sig.	b	sig.
Female[a]	-.090	**	-.074	**	-.068	**	-.066	**
Minority[b]	-.010		-.008		-.013		-.007	
Ph.D.[c]	.200	**	.121	**	.140	**	.112	**
Years of experience	.018	**	.005	**	.007	**	.006	**
A quadratic term	-.017	**	2.05E-05		-1.30E-05		-2.22E-05	
Teaching[d]	-.072	**	-.086	**	-.086	**	-.040	**
# of articles(career)	.001	**	7.05E-04	**	7.88E-04	**	5.99E-04	**
# of articles(2 years)	.011	**	.012	**	.009	**	.008	**
Union[e]	.032	**	.027	**	.039	**	.077	**
Length of appointment	.050	**	.054	**	.048	**	.045	**
Associate professor[f]			-.163	**	-.170	**	-.180	**
Assistant professor[f]			-.264	**	-.273	**	-.291	**
Agriculture					-.085	**	-.079	**
Business administration					.144	**	.166	**
Education					-.082	**	-.053	**
Engineering					.107	**	.102	**
Fine Arts					-.100	**	-.106	**
Health Science					.111	**	.107	**
Humanities					-.120	**	-.109	**
Natural Science					-.077	**	-.061	**
Social Science					-.056	**	-.048	**
Research universities[g]							.147	**
Doctoral universities[g]							.046	**
Institutional control[h]							.066	**
Constant	9.925	**	10.231	**	10.284	**	10.167	**
Adjusted R^2	.407		.455		.518		.551	
F	488.35**		494.44**		364.34**		363.03**	
n	7090		7090		7090		7090	

** $p < .01$

Note: Reference groups are a) male, b) white, c) those holding a master or a bachelor degree, d) research as a principal activity at the institution, e) non-union member, f) full professor, all other programs, g) comprehensive universities, and h) public universities, respectively.

Table 5. Summary Statistics for Separate Regression Models by Sex

Variable	Basic model				with Rank			
	Male		Female		Male		Female	
	b	sig.	B	sig.	b	sig.	b	sig.
Minority[a]	-.024	*	.032		-.024	*	-.013	*
Ph.D.[b]	.202	**	.183	**	.128	**	.098	**
Years of experience	.018	**	.020	**	.005	**	.008	**
A quadratic term	-.017	**	-2.96E-04		3.83E-05		-1.41E-04	
Teaching[c]	-.076	**	-.055	**	-.088	**	-.077	**
# of articles(career)	.001	**	9.04E-04	*	8.10E-04	**	1.97E-04	**
# of articles(2 years)	.009	**	.020	**	.010	**	.020	**
Union[d]	.032	*	.038	**	.031	**	.023	
Length of appointment	.051	**	.044	**	.055	**	.049	**
Associate professor[e]					-.160	**	-.180	**
Assistant professor[e]					-.256	**	-.285	**
Agriculture								
Business administration								
Education								
Engineering								
Fine Arts								
Health Science								
Humanities								
Natural Science								
Social Science								
Research universities[f]								
Doctoral universities[f]								
Institutional control[g]								
Constant	9.909	**	10.231	**	10.213	**	10.210	**
Adjusted R^2	.371		.329		.416		.401	
F	349.45**		97.01**		346.57**		108.08**	
N	5328		1761		5328		1761	

* $p < .05$, ** $p < .01$

Note: Reference groups are a) white, b) those holding a master or a bachelor degree, c) research as a principal activity at the institution, d) non-union member, e) full professor, all other programs, f) comprehensive universities, and g) public universities, respectively.

(*continue*)

Variable	with Discipline				with Institutional type			
	Male		Female		Male		Female	
	b	sig.	b	sig.	b	sig.	b	sig.
Minority[a]	-.035	*	.039	*	-.025	**	-.038	*
Ph.D.[b]	.122	**	.139	**	.095	**	.118	**
Years of experience	.006	**	.011	**	.005	**	.010	**
A quadratic term	4.40E-06	*	-1.66E-04	**	-5.00E-06		-1.75E-04	**
Teaching[c]	-.086	**	-.066	**	-.042	**	-.015	
# of articles(career)	8.89E-04	**	1.34E-04		6.65E-04	**	5.094E-05	
# of articles(2 years)	.008	**	.017	**	.007	**	.008	**
Union[d]	.043	**	.029	*	.085	**	.015	**
Length of appointment	.047	**	.045	**	.043	**	.041	**
Associate professor[e]	-.172	**	-.181	**	-.183	**	-.186	**
Assistant professor[e]	-.275	**	-.284	**	-.296	**	-.062	
Agriculture	-.091	**	-.058		-.082	**	-.079	**
Business administration	.132	**	.178	**	.157	**	.193	**
Education	-.082	**	-.084	**	-.047	**	-.067	**
Engineering	.102	**	.224	**	.098	**	.206	**
Fine Arts	-.119	**	-.076	**	-.120	**	-.092	**
Health Science	.164	**	.056	**	.155	**	.054	**
Humanities	-.128	**	-.105	**	-.115	**	-.099	**
Natural Science	-.083	**	-.027		-.066	**	-.012	
Social Science	-.054	**	-.067	**	-.045	**	-.061	**
Research universities[f]					.154	**	.122	**
Doctoral universities[f]					.054	**	.023	
Institutional control[g]					.072	**	.049	**
Constant	10.329	**	10.216	**	10.195	**	10.131	**
Adjusted R^2	.491		.466		.527		.494	
F	257.45**		77.82**		258.75**		75.64**	
n	5328		1761		5328		1761	

* $p < .05$, ** $p < .01$

Note: Reference groups are a) white, b) those holding a master or a bachelor degree, c) research as a principal activity at the institution, d) non-union member, e) full professor, all other programs, f) comprehensive universities, and g) public universities, respectively.

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Table 6. Estimates of the Proportion of Discrimination by Sex in 1992

Regression Model	Percentage of Discrimination[b]
Total salary differential[a]	25%
Average male faculty salary	$50,513
Average female faculty salary	$40,538
Basic regression	11%[c]
with rank variables	10%
with discipline variables*	10%
with institutional type variables*	10%

Note: * The current model includes all the variables in the previous models.
[a] From the basic model.
[b] Results only from the new female salary.
[c] about $4,000